



SIN 09/605,053

Group 1619

#5

UNITED STATES PATENT AND TRADEMARK OFFICE

I, Norval O'CONNOR BSc, PhD,
translator to RWS Group plc, of Europa House, Marsham Way, Gerrards Cross,
Buckinghamshire, England declare;

1. That I am a citizen of the United Kingdom of Great Britain and Northern Ireland.
2. That I am well acquainted with the French and English languages.
3. That the attached is, to the best of my knowledge and belief, a true translation into the English language of the accompanying copy of the specification filed with the application for a patent in France on 4 March 1996 under the number 96/02,662 and the official certificate attached hereto.
4. That I believe that all statements made herein of my own knowledge are true and that all statements made on information and belief are true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the patent application in the United States of America or any patent issuing thereon.

For and on behalf of RWS Group plc

The 8th day of September 1999

FRENCH REPUBLIC

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P A T E N T

UTILITY CERTIFICATE - CERTIFICATE OF ADDITION

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The Director of the National Institute of Industrial Property certifies that the attached document is a true copy of an application for industrial property titleright filed at the Institute.

Drawn up in Paris, 16 JAN. 1997

On behalf of the Director of the National
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The Divisional Head

(signature)

Yves CAMPENON

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NATIONAL PUBLIC ESTABLISHMENT

CREATED BY LAW NO. 51-466 OF 13 APRIL 1951

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APPLICATION FOR THE GRANTING OF AN INDUSTRIAL PROPERTY TITLE RIGHT*		COMPULSORY OPTIONS at the time of filing (except for utility certificate) THE APPLICANT REQUESTS THE DIFFERED FORMULATION OF THE DOCUMENTATION REPORT <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO IF THE OPTION SELECTED IS NO AND IF THE APPLICANT IS A PHYSICAL PERSON HE REQUESTS THE GRADUATED PAYMENT OF THE TAX ON THE DOCUMENTATION REPORT <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	
a <input checked="" type="checkbox"/> PATENT b <input type="checkbox"/> UTILITY CERTIFICATE c <input type="checkbox"/> DIVISIONAL APPLICATION d <input type="checkbox"/> CONVERSION OF A EUROPEAN PATENT APPLICATION		NATURE NUMBER DATE OF INITIAL APPLICATION	
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3 NAME AND ADDRESS OF THE APPLICANT OR THE REPRESENTATIVE TO WHOM ALL THE CORRESPONDENCE SHOULD BE ADDRESSED Mrs Elisabeth THOURET-LEMAITRE SYNTHELABO Patents Department P.O. Box 72 92352 LE PLESSIS ROBINSON CEDEX			

7 TITLE OF THE INVENTION

Sustained-release pharmaceutical formulations containing mizolastine

8 APPLICANT: SURNAME AND CHRISTIAN NAMES (UNDERLINE THE SURNAME) OR NAME AND LEGAL CONSTITUTION

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10 NATIONALITY

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TAXES PAID

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11 INVENTOR(S) THE APPLICANT IS THE SOLE INVENTOR

☐ YES

If the answer is no see explanatory note

☒ NO

12 IF THE APPLICANT IS A PHYSICAL PERSON NOT SUBJECT TO REVENUE COLLECTION, HE REQUESTS OR HAS REQUESTED REDUCTION OF THE TAXES

☐ YES

☐ NO

☒ ON DOCUMENTATION REPORT

☐ ON CLAIM TO PRIORITY

☐ ON CLAIM (from the 11th onwards)

13 PRIORITY DECLARATION OR APPLICATION FOR THE BENEFIT OF THE FILING DATE OF A PRIOR APPLICATION

COUNTRY OF ORIGIN

FILING DATE

NUMBER

14

DIVISIONS

PREVIOUS

TO THE PRESENT No.

No.

No.

No.

APPLICATION

15 SIGNATURE OF THE APPLICANT OR HIS REPRESENTATIVE NAME AND POSITION OF SIGNATORY REGISTRATION NO.

(signature)
E. THOURET-LEMAITRE

SIGNATURE OF THE RECEIVING OFFICIAL

SIGNATURE AFTER REGISTRATION OF THE APPLICATION AT THE N.I.I.P

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* Tick the relevant box

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Patents Administrative Division

DESIGNATION OF THE INVENTOR

(if the applicant is not the
inventor or the sole inventor)

National Registration No.

96/02,662

Title of the invention:

Sustained-release pharmaceutical formulations containing
mizolastine

The undersigned

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NOTE: In exceptional cases, the name of the inventor may be followed by that of the
company to which he belongs (membership company) when the latter is other than the
company which is the applicant or titleholder.

Date and signature(s) of the applicant(s) or of the
representative

4 March 1996

(signature)

E. THOURET-LEMAITRE

BA 113/160392

The present invention relates to novel sustained-release pharmaceutical formulations containing 2-[[[1-[1-[(4-fluorophenyl)methyl]-1H-benzimidazol-2-yl]piperid-4-yl]methylamino]-pyrimidin-4-ol or 2-[[[1-[1-[(4-fluorophenyl)methyl]-1H-benzimidazol-2-yl]piperid-4-yl]methylamino]-pyrimidine-4(1H)-one, or mizolastine, as active principle.

Mizolastine is described in European patent EP 0,217,700.

Mizolastine binds to the H₁ histamine receptor and inhibits the degranulation of mastocytes in vitro and in vivo. It can thus be used for the treatment of respiratory, cutaneous or ocular allergies and various allergic manifestations.

During the oral administration of immediate-release formulations containing mizolastine, undesirable sedative effects have been observed which are associated with the existence of a high peak in the plasma.

Consequently, it was necessary to find formulations for an oral administration which have a profile of release of the active principle such that it is possible to obtain a lower peak in the plasma without decreasing the bioavailability.

The Applicant Company has based its research of such formulations on the study of the kinetics of dissolution of mizolastine. The reason for this is that

mizolastine is a weak base (pK 5.6) which is sparingly soluble in water (13 mg/l at neutral pH) but much more soluble at acidic pH (11 g/l at pH 3); the first gelatin capsules released 100 % of mizolastine over
5 30 minutes in a dissolution medium at pH 2 whereas only 40 % were dissolved at pH 6.8.

Moreover, the release of mizolastine from the sustained-release pharmaceutical form according to the invention did not need to be influenced by the
10 differences in pH in the gastrointestinal tract.

The aim of the present invention is to propose formulations containing mizolastine whose dissolution profile is as follows:

- about 30 to 70 % of mizolastine dissolved
15 in 1 hour,
- 100 % of mizolastine dissolved in 3 to 5 hours, and
- pH-independent profile.

The Applicant Company has shown that tablets
20 containing a core formed of a sustained-release tablet containing mizolastine combined with a fatty matrix and with an acid of low pK, the said tablet being coated to prevent degradation of the product by light, are entirely suitable.

25 The tablets according to the invention contain from 1 mg to 25 mg of mizolastine. These doses correspond to concentrations of from 0.5 % to 12 % by weight of mizolastine.

The fatty matrix is made with hydrogenated
castor oil or with hydrogenated lecithins or long-chain
fatty acids such as behenic acid or triglycerides
esterified with medium-chain fatty acids, for example
5 C₈-C₁₈ fatty acids.

The acid of low pK is chosen from maleic,
tartaric, malic, fumaric, lactic, citric, adipic and
succinic acids in the form of racemates or isomers.

According to the invention, the acid
10 particularly preferred is L-tartaric acid.

The weight ratio between the mizolastine and
the acid of low pK should be between 0.3 and 1. With
L-tartaric acid, this ratio is preferably equal to 0.5.

The tablets are prepared by granulation using
15 the active principle, the agent constituting the fatty
matrix, the acid of low pK and other excipients such
as, for example, lactose, mannitol and sugars or
similar sugar-alcohols, microcrystalline cellulose,
starch, calcium phosphates and sulphates, polyvidone,
20 and substituted celluloses such as hydroxypropyl-
cellulose, hydroxypropylmethylcellulose or
methylcellulose.

The granulation may be carried out in a wet
phase, for example in the presence of water or alcohol,
25 or may be performed by fusion or by compacting. The
granulation step may optionally be left out and the
tablets prepared by direct tableting of the mixture of
the mizolastine and the excipients.

Anhydrous colloidal silica and magnesium stearate are added to the granules obtained and the mixture is tableted. The tablets are then covered with a coating film by spraying them with a coating solution in a machine with a fluidized-air bed or in a coating turbine.

The example which follows illustrates the invention without limiting it:

<u>Tablet</u>		
		% (weight)
10	mizolastine	4.8
	hydrogenated castor oil	12.0
	lactose	60.0
	microcrystalline cellulose	9.6
15	L-tartaric acid	9.6
	polyvidone	2.9
	anhydrous colloidal silica	0.2
	magnesium stearate	0.9
	purified water	Q.S.
20	Total	100.0

<u>Coating</u>		
	methylhydroxypropylcellulose	74.0
	titanium dioxide (E171)	18.5
	propylene glycol	7.5
25	purified water	Q.S.
	Total	100.0

The dissolution profile obtained with a formulation according to the invention is given in Figure 1.

This profile gives about 50 % of product dissolved in 1 hour, 100 % of product dissolved in 3 to 5 hours, and it is independent of the pH.

The dissolution profile obtained with a formulation identical to that of the invention but containing no L-tartaric acid is given in Figure 2.

10 The plasma kinetics of a pharmaceutical form according to the invention containing 10 mg of mizolastine were studied in a healthy volunteer after a single oral administration, compared with a standard immediate-release gelatin capsule containing 10 mg of
15 mizolastine.

Table 1 presents the kinetic parameters and Figure 3 the curves of the plasma kinetics, obtained respectively with each formulation; the plasma kinetics obtained with the pharmaceutical form according to the
20 invention makes it possible to prevent any peak in the plasma without losing bioavailability.

The plasma kinetics of a pharmaceutical form according to the invention were also studied in comparison with the same formulation without L-tartaric
25 acid.

The study was performed on twelve healthy volunteers after a single oral administration of a tablet according to the invention containing 10 mg of

mizolastine or the same tablet without L-tartaric acid.

Table 2 shows that the bioavailability of the formulation containing no L-tartaric acid represents only 43 % of that observed with the formulation according to the invention containing L-tartaric acid. The values of C_{max} and the AUC values (0-∞) are respectively 1.5 and 2 times as high for the formulation containing L-tartaric acid as for that not containing any.

In addition, for the formulation with L-tartaric acid, the min.-max. variation indices are much lower, which suggests great uniformity in the release.

The results altogether show that the formulations according to the invention have:

- a pH-independent dissolution profile,
- an *in vivo* release which prevents any peak in the plasma,
- a bioavailability which is not decreased relative to an immediate-release formulation,
- lower variability of the plasma kinetics results.

CLAIMS

1. Sustained-release pharmaceutical
formulation containing mizolastine, characterized in
that it contains a core formed of a sustained-release
5 tablet containing mizolastine combined with a fatty
matrix and with an acid of low pK, the said tablet
being coated.

2. Sustained-release pharmaceutical
formulation according to Claim 1, characterized in that
10 the weight ratio between the mizolastine and the acid
of low pK is between 0.3 and 1.

3. Sustained-release pharmaceutical
formulation according to either of Claims 1 and 2,
characterized in that the fatty matrix is made with
15 hydrogenated castor oil or with hydrogenated lecithins
or long-chain fatty acids or triglycerides esterified
with medium-chain fatty acids.

4. Sustained-release pharmaceutical
formulation according to any one of Claims 1 to 3,
20 characterized in that the acid of low pK is chosen from
maleic, tartaric, malic, fumaric, lactic, citric,
adipic and succinic acids in the form of racemates or
isomers.

5. Sustained-release pharmaceutical
25 formulation according to any one of Claims 1 to 4,
characterized in that the acid of low pK is L-tartaric
acid.

6. Sustained-release pharmaceutical formulation according to Claim 5, characterized in that the ratio between the mizolastine and the L-tartaric acid is 0.5.

5 7. Formulation according to any one of Claims 1 to 6, characterized in that it contains from 1 to 25 mg of mizolastine.

Figure 1

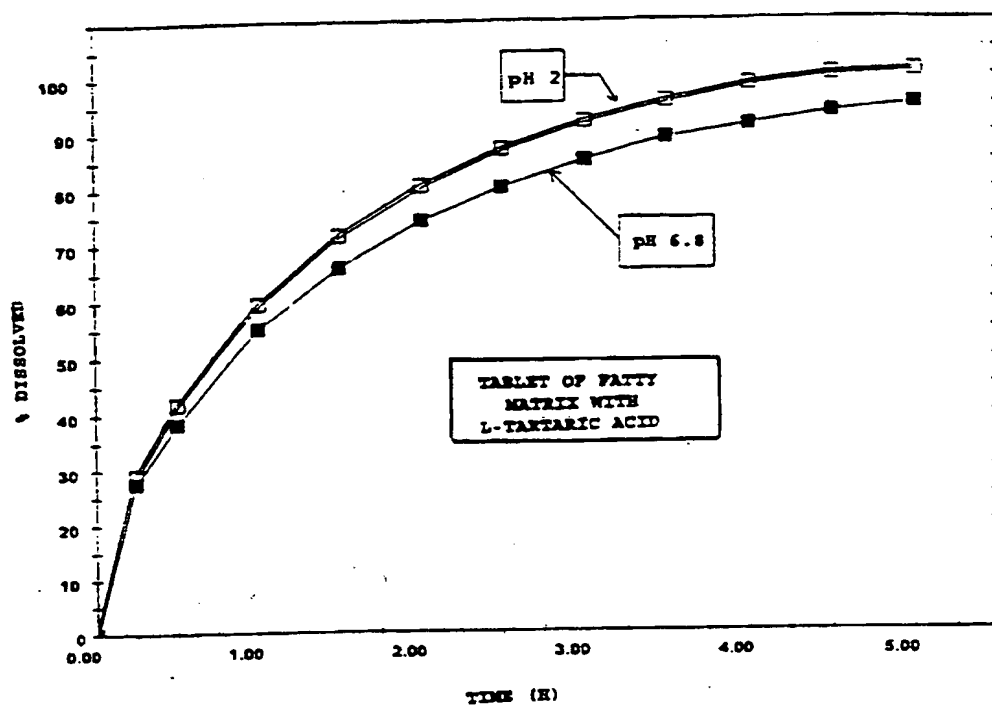


Figure 2

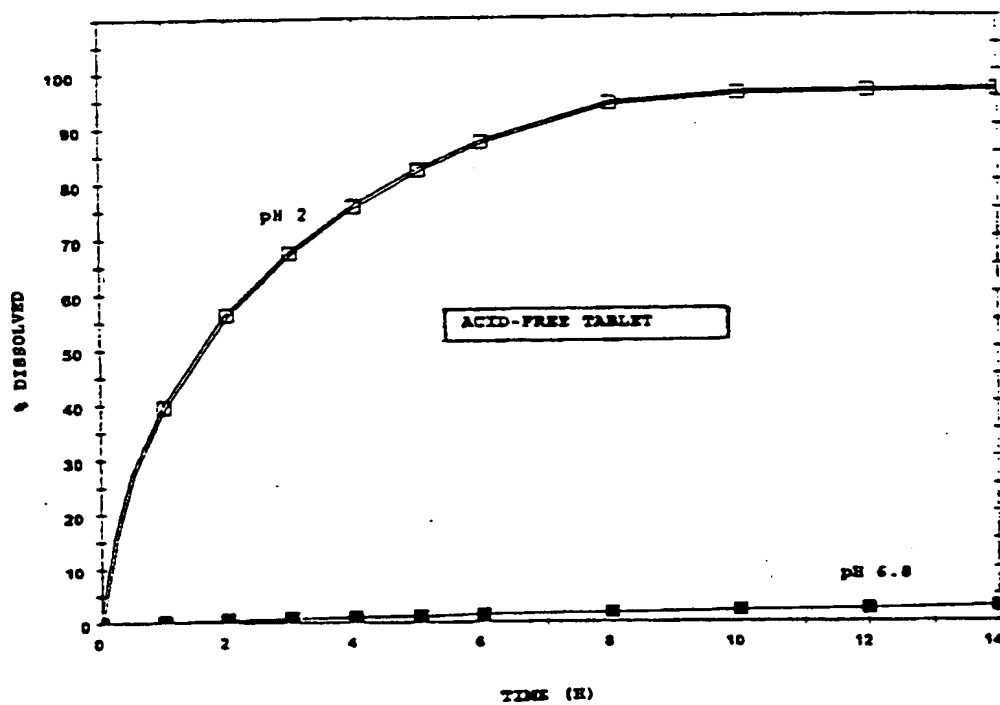


Table 1

Formulation	Tmax (h)	Cmax (ng/ml)	t _{1/2} β (h)	AUC(0- ∞) (ng.ml ⁻¹ .h)	Frel
Gelatin capsule	0.9	398.4 \pm 22.7	14.8 \pm 1.5	1481 \pm 96	
Min-Max	0.5-1.5	202-529	6.7 \pm 33.1	1092-2717	
Tablet	1.4	234.2 \pm 13.7	14.5 \pm 1.2	1406.1 \pm 119	0.962
Min-Max	0.5-2.5	154-393	6.7-26.4	775-2458	
Statistical comparison	NS	p<0.001	NS	NS	

Figure 3

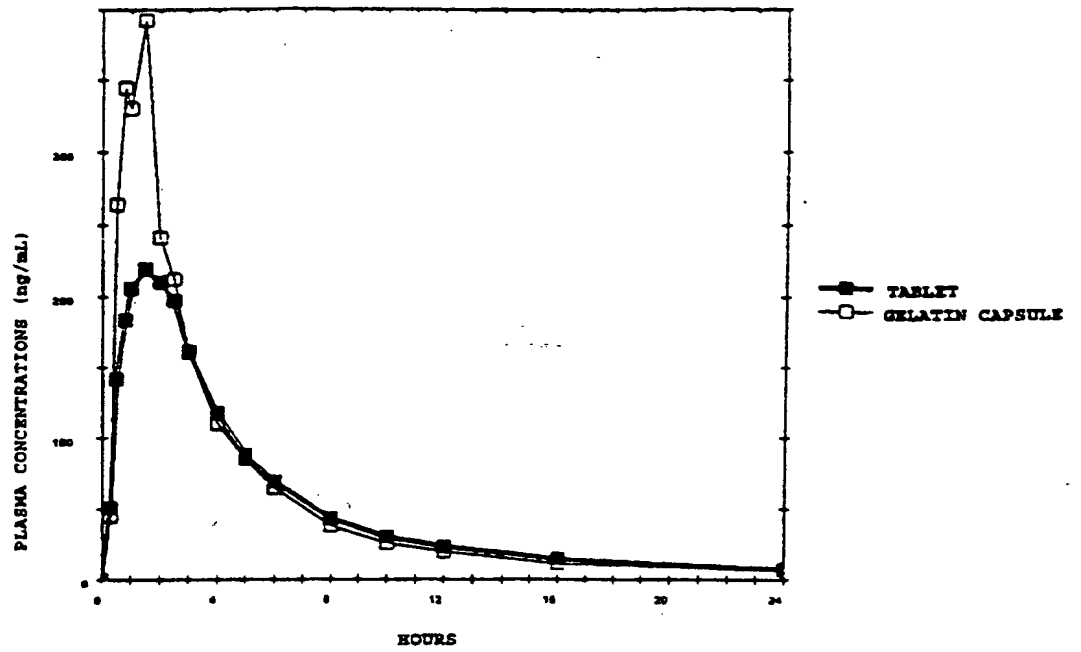


Table 2

Formulation	Tmax (h)	Cmax (ng/mL)	t1/2 β (h)	AUC(0-t) ng·ml ⁻¹ ·h	AUC(0- ∞) ng·ml ⁻¹ ·h	Frel
With L-tartaric acid	1.00	243.7 \pm 12.7	13.1 \pm 1.2	1347 \pm 117	1444 \pm 125	
Min-Max	0.75-2.5	166.5-314.1	5.9 \pm 19.4	734-1878	773-2011	
Without L-tar-taric acid	0.75	147.0 \pm 28.8	12.9 \pm 1.1	601 \pm 134	635 \pm 139	0.43 \pm 0.08
Min-Max	0.5-2.5	4.5-285.4	5.1-17.6	27-1347	38-1397	0.03-0.87
Statistical comparison	NS	p<0.05	NS	p<0.01	p<0.01	